SOIL CONSERVATION

HENRY A. WALLACE
Secretary of Agriculture

H. H. BENNETT
Chief, Soil Conservation Service

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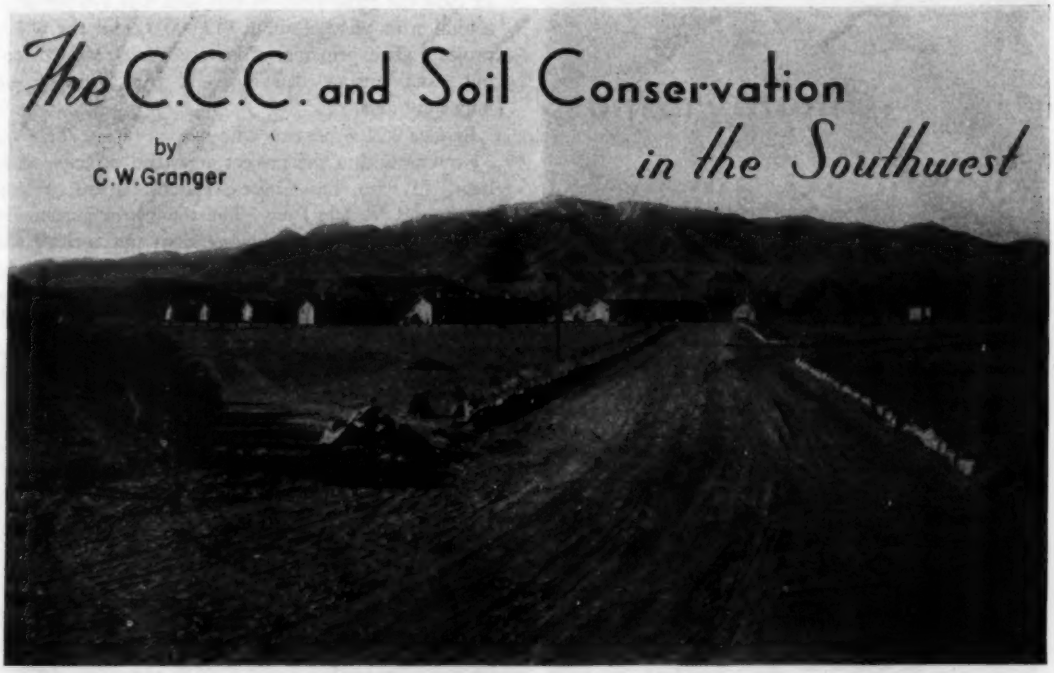
The C.C.C. and Soil Conservation in the Southwest

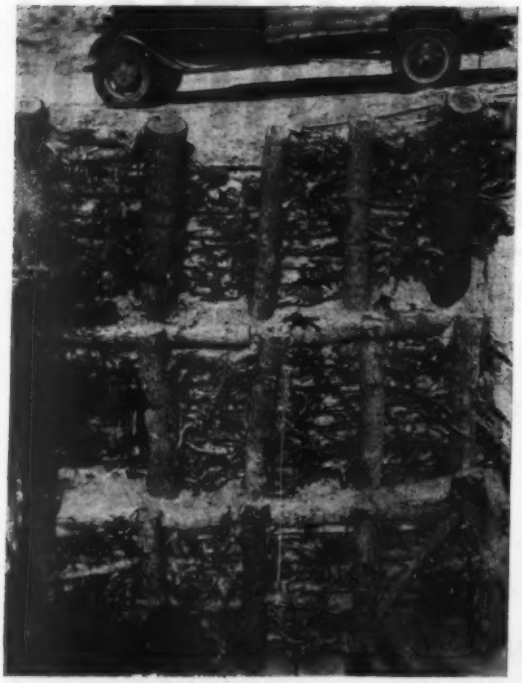
by
C.W.Granger



MORE than 300 years ago Coronado's Spanish conquistadores started north from Mexico City in search of Gran Quivira, about which stories of fabulous wealth were told by the Indians. One route followed was that through El Paso del Norte the Pass of the site of El Paso, Tex. In their early American conquests the Spanish soldiers were always accompanied by members of the clergy who hoped to establish missions and Christianize the Indians. As early as 1630 a few of the Spaniards settled along the Rio Grande near the present location of Ysleta and began farming operations. There they found a rich alluvial soil which they irrigated with water from the Rio Grande by means of a crude diversion system. Farming and stock-raising continued to be practiced in the vicinity of Ysleta and El Paso, but it was not until 1840 that a farming settlement was established in the Rio Grande Valley, above El Paso.

Flood Hazard Reduced

In 1904 about 39,000 acres in El Paso Valley, Mesilla Valley, and Rincon Valley were under irrigation, but there were no permanent diversion structures nor any storage facilities. Under authority of the Reclamation Act of 1902 feasibility of an irrgation project in the area was announced. The Bureau of

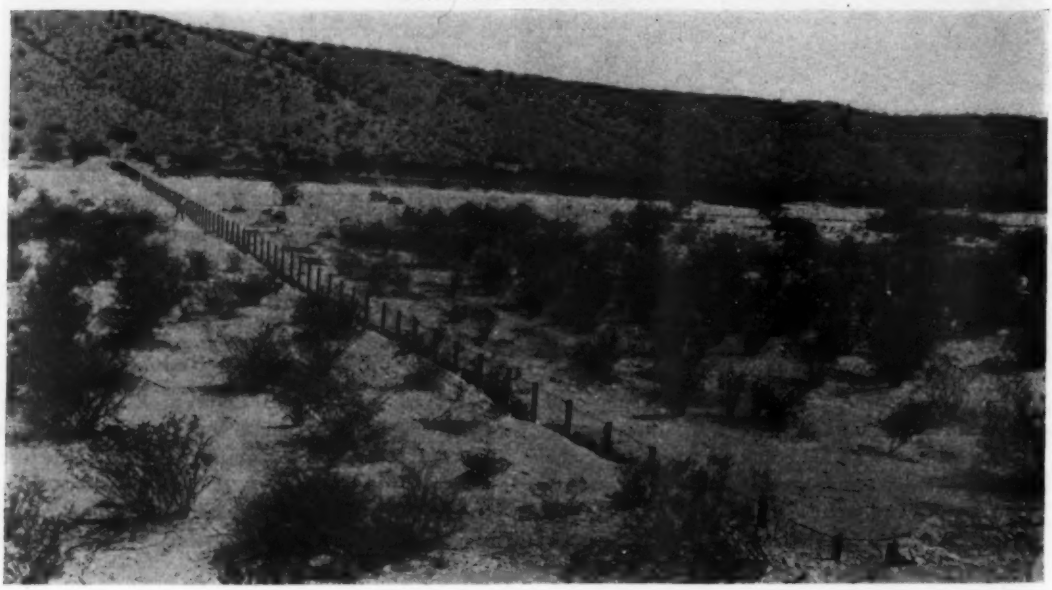


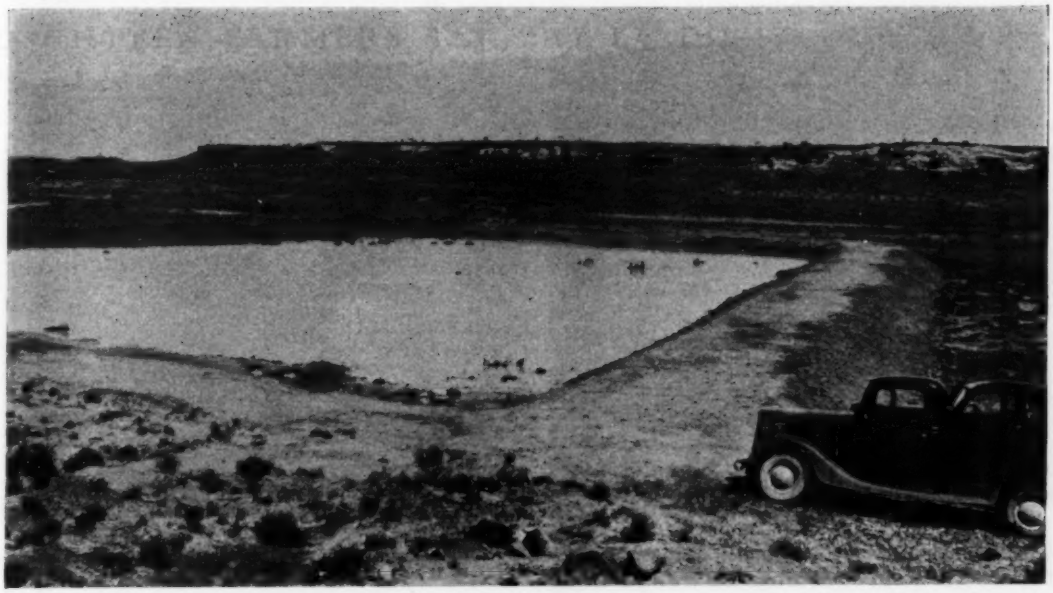
Inexpensive pole and wire riprap to prevent further erosion of highway roadbed.

Reclamation immediately began to plan for the construction of a storage dam and an adequate system of diversion structures and canals, though actual operations were not begun until 1910. Engineers approved a location 120 miles north of El Paso where today we have the Elephant Butte Dam and Reservoir which supplies water for the fourth largest Government irrigation project, and very materially lessens the flood hazard downstream. The dam and auxiliary construction units represent a total cost of slightly more than $15,000,000 and supplies water for 155,000 acres of land which is divided into about 5,000 farms. In 1934 the gross yield on this land was $76 per acre, a total gross yield of about $12,000,000 for the whole project. The principal crops are alfalfa and cotton; but stock raising, dairying, and fruit growing are important also.

Besides 26,108 persons who live on farms, there are 37 towns within the project area, the principal ones being El Paso, Las Cruces, Hatch, Fabens, Ysleta, Clint, and Mesilla Park. The total farm investment is $47,500,000 but that figure does not include the value of town and city property; utilities, railroads, and other industries; schools; highways; and other improvements. Besides the New Mexico State College of Agriculture at Las Cruces and the Texas State College of Mines at El Paso, there are many high

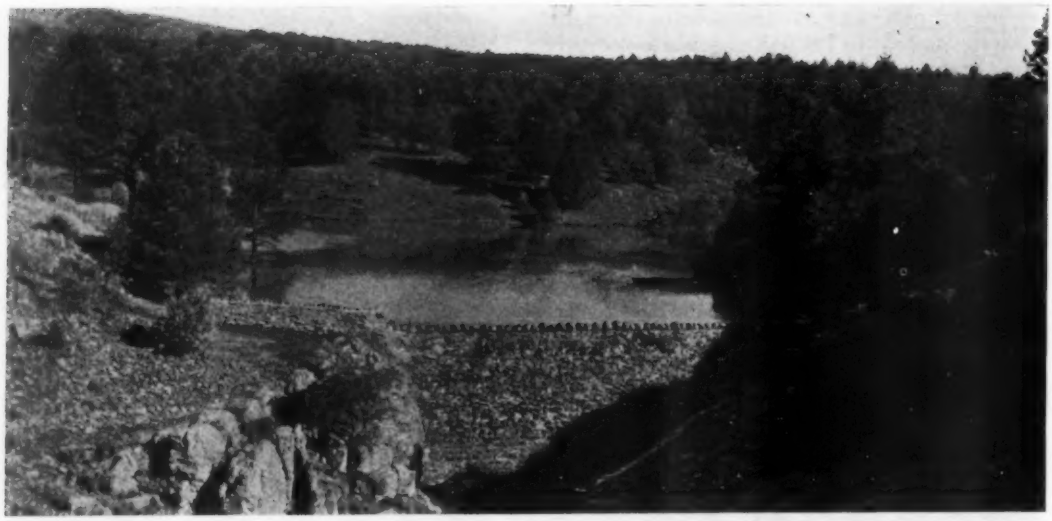
This rail and wire check and water-spreader extends 1,000 feet across Wyneam Canyon. It is one unit of a flood-control project in the Rio Grande district. It was constructed by the C. C. C. under supervision of the Soil Conservation Service.





Dam constructed by C. C. C. under direction of Soil Conservation Service, to provide water for stock. Rio Grande district.

Percolating log and rock dam to check flow until cottonwood and willow cuttings become established.



Small rubble masonry dam impounding water for stock and serving to check flow of flood water. Another structure in the Rio Grande district built by the C. C. C. under direction of the Soil Conservation Service.

schools and rural schools on the project, in all 87 scholastic institutions. There are 6 banks, 124 churches, and 23 railroad stations. Electric power from El Paso is available to all residents of the area. If it is ever considered advisable to produce power at Elephant Butte, it can be accomplished by the construction of another dam downstream.

Sedimentation Threatens

This immense reservoir which has a capacity to impound 2,638,860 acre-feet of water—enough to irrigate the whole project for 2 years even if there is no accumulation during that time—is in danger of having its value seriously impaired because of sedimentation. At this time, 20 years after its completion, the reservoir storage has been depleted by 13.84 percent through accumulation of silt. Due to overgrazing, a considerable portion of the Rio Grande watershed has been almost denuded of vegetative cover; as a result, hard rains, typical of the Southwest, wash into the streams a large volume of silt which is carried on down-stream to be deposited finally in Elephant Butte Reservoir.

Protection of the Elephant Butte project is one of the problems that faced the Service when it was created in 1933, and plans were made to determine possible remedial measures. It is believed that if vegetative cover can be brought back, only a relatively small amount of silt will find its way into the Rio Grande. In order to restore vegetation three things are necessary: Soil must be stabilized; moisture sufficient to germinate and nourish vegetation must be conserved; grazing must be regulated.

In the Rio Grande district some of the land that needs to be treated is privately owned; for control of grazing on this land cooperative agreements have been made with the owners. There are also several thousand acres purchased by the Resettlement Administration for the eventual use of Indians; the Indian Service is cooperating with the Soil Conservation Service to control grazing on this area. It is quite obvious that other control measures involve operations that require a large amount of labor if they are to be followed along a scale comprehensive enough to enable the Service to deduce rather definite opinions.

Ten Camps Established

Under the supervision of Hugh G. Calkins, regional conservator, Soil Conservation Service, eight C. C. C. camps were established in the fall of 1935 on the Rio Grande watershed; one on the Rio Grande proper at Las Cruces, N. Mex., below Elephant Butte Reservoir; three on the Rio Chama; two on the Rio Puerca; and two on the Rio Jemez. In April 1936 a camp was placed near Kingston, N. Mex., at the head of Perchas Creek, which empties into the Rio Grande below the reservoir. The three camps located below the dam are engaged primarily in flood-control work to protect farm and city property located below the dam from

(*Continued on p. 173*)

EIGHTEEN FARMERS SAY "WE'LL DO IT OURSELVES"

By Lyman Carrier [1]

The Soil Conservation Service and the Virginia State Extension Service decided during the summer of 1936 to test the possibility of spreading the benefits of soil conservation more rapidly over the State. Charlotte County was selected because the farmers there had shown sufficient interest in controlling erosion to organize a soil conservation association and purchase a terracing outfit. Charlotte County is typical of a large area of the southern Piedmont region of Virginia. Approximately 80 percent of the farming land has lost from one-fourth to three-fourths of its topsoil by erosion. Tobacco growing has been the main farming industry for many years; but of late there is a tendency toward a more diversified agriculture with increased livestock production.

Eighteen Farmers Selected

To start the program, the county agent, H. E. McSwain, selected 18 farmers scattered over the county and issued to them invitations to attend a soil conservation meeting. Seventeen responded. After it was fully explained to these farmers that all the assistance they might expect from the Government would be technical guidance and supervision and that they must themselves furnish labor, materials, seeds, fertilizers, and underwrite what terracing was necessary, they agreed to go ahead with the work. Later another farmer was added to the list, making 18 in all.

The next step was the making of soil, erosion, slope, and land-use maps for each farm. These were made by F. F. Nickels and D. D. Montgomery, of the Soil Conservation Service, with the help of draftsmen of project no. 2, Lynchburg.

Then came the development of farm plans. It was proposed to give these farmers complete coordinated programs covering a 5-year period, such as those embodied in the agreements drawn for the farm cooperators in the demonstration and camp areas. When completed, the plans were approved by the farmer, the county agent and his assistant, the extension agronomist, the S. C. S. conservationist, and the project manager.

There is nothing in these memoranda of understanding which is legally binding on either Government or farmer.

[1] State coordinator, Soil Conservation Service, Blacksburg, Va.

The 18 farms contained 4,596 acres, 2,241 acres of which was cultivated or in pasture, and the remainder woods, roads, or other nonagricultural land.

A regular crop rotation was established on each farm wherever practicable. Nine hundred and sixty-three acres are to be in general farm rotations and 333 acres in special tobacco rotations. Of these 1,296 acres, 420 are either entirely new rotations or improvements on the cropping systems which have been in practice in the past.

Eight of the farms had fields adaptable to strip cropping, and 315 acres are to be farmed after that method. This is a new feature in the community.

Eight hundred and eighteen acres are to be contour-tilled—another innovation locally. Two hundred and fifteen acres will be terraced.

The new plans call for 717 acres of pasture and 166 acres of permanent meadow; of these, 272 and 120 acres respectively are on lands to be retired from cultivation. Five hundred and seventy-three acres of pasture lands are to be reseeded, 604 acres limed, 123 acres treated with superphosphate, and 495 acres are to have an application of a complete fertilizer.

Croplands other than pastures are to have 403 acres reseeded, 1,337 limed, 65 phosphated, 1,282 treated with a complete fertilizer, and 125 manured.

Cooperating Farmers Furnish Materials

Of the 2,241 acres of croplands on these farms, the agreements call for special treatment for 2,025 acres. To carry out the agreements, the farmers must supply 14,045 pounds of a pasture-mixture seed, 2,538 pounds of hay mixture, 180 pounds of meadow-strip mixture (for terrace-outlet channels), 840 pounds clover, 1,900 pounds alfalfa, 1,436 pounds redtop, 4,095 pounds lespedeza, and 840 pounds orchard grass. The fertilizer treatments require 1,655 bags of 0–12–5; 2,864 bags complete fertilizer, 4–12–4; 264 bags 16 percent superphosphate, 2,476 tons of lime, and 336 tons of manure.

Wood Lot Improvement

As over half the area of these farms is in woods, it did not seem advisable to retire any of the land to forest planting. It is the intention, however, as soon as a forester is available for the work, to give these farmers instructions in wood-lot improvement, marking for them, on small areas of 1 or 2 acres, the trees which should be kept.

The responsibility for the future supervision of the program on these 18 farms rests mainly on the county agent and his assistants. One of the assistants, P. A. Robinson, is employed jointly by the Extension Service and the Soil Conservation Service to supervise the terracing operations. He will lay off the contour lines as needed, and supervise the construction. The technicians of the Soil Conservation Service will visit the county occasionally to confer with the county agent on the progress of the work and to assist the farmers whenever their services are needed.

The total costs to the Soil Conservation Service for this project to date, counting the actual time devoted to it, amount to but $728.50, with salaries and expenses of the extension workers estimated at only $600.

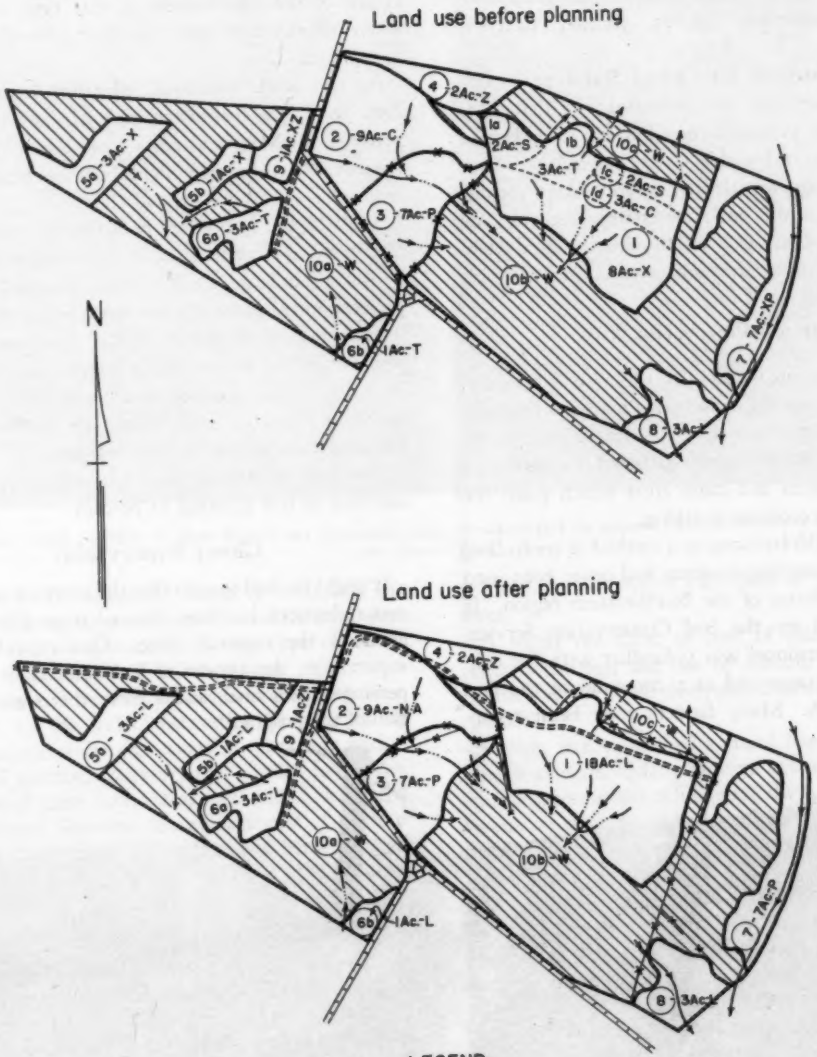
The accompanying statistical analysis and land-use maps of the H. W. Lawson farm in Charlotte County will serve to indicate what is being done by the cooperating farmers.

(*Continued on p. 188*)

Cropping plan—H. W. Lawson farm

Field No.	Field Sec.	Acres	Before contract	New cropping plan and treatment				
				1937	1938	1939	1940	1941
1	.....	18	Idle, 8 acres Corn, 3 acres Tobacco, 3 acres Peas, 4 acres	Wheat Lespedeza Grass Corn, 3 acres	Corn, 6 acres Wheat, 6 acres Lespedeza Grass, 6 acres	Wheat Lespedeza Grass Corn	Lespedeza Grass Corn Wheat	Corn. Wheat. Lespedeza. Grass.
				Field to be divided into 3 6-acre fields for 3-year rotations as soon as terraced. 6 acres wheat to receive 10 tons ground limestone in fall of 1936 before seeding wheat; other 12 acres to receive 10 tons of ground limestone per 6 acres as they come into wheat. Corn to receive 300 pounds 4–12–4 fertilizer per acre. Wheat to receive 300 pounds 4–12–4 fertilizer per acre. Clover to be mixed with lespedeza and grass as land is limed and fertilized and will produce it. 0–12–5 fertilizer to be substituted for 4–12–4 fertilizer as soon as some clover and lespedeza is turned under.				
2	.....	9	Corn (each year)	Lespedeza Grass	Lespedeza Grass	Lespedeza Grass	Lespedeza Grass	Lespedeza. Grass.
				Field to receive at least 1 ton ground limestone per acre and 200 to 300 pounds 0–12–5 fertilizer per acre. To be seeded with mixture of grass and lespedeza to be used as permanent meadow.				
3	.....	7	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture.
				In broom sedge and wild lespedeza, to be seeded in redtop, orchard grass, and lespedeza after fields 1 and 2 have been fertilized, limed, and seeded. Lime and fertilizer same as for field no. 2 or permanent meadow. Woodland to be fenced out of pasture.				
4	.....	2	Truck crops	Garden, truck crops, etc.				
5	a and b	4	Idle	Tobacco	Wheat	Redtop	Tobacco	Wheat.
6	a and b	4	Tobacco	Redtop	Tobacco	Wheat	Redtop	Tobacco.
				By 1939 operator plans to clear sufficient land to run a 3-year rotation and if found desirable, allow Helena soil of field no. 5 to return to meadow. Clearing to be done so that fields are correctly sloped and no steep land cleared.				
7	.....	7	Idle Pasture	Pasture Bottom land	Pasture	Pasture	Pasture	Pasture.
8	.....	3		To act as catch crop field with mostly corn until rotation is established. Use 300 pounds 4–12–4 fertilizer on corn per acre.				
9	.....	1	Truck and garden					
10	.....	75	Woods, roads, and other lands					
				1. The Government (S. C. S.) agrees to cooperate with the landowners in a woodland-management program and furnish a forester for technical supervision. 2. The cooperator agrees to protect to the best of his ability his woodland area from fire and improper grazing and cutting. 3. The Government (S. C. S.) agrees to mark 2 acres for a forest stand improvement demonstration on the farm.				

H. W. LAWSON FARM



LEGEND

- A Land removed from cultivation for other use
- C Corn
- L Cultivated land
- N Grasses or perennial legumes for hay
- P Pasture - permanent
- S Peas
- T Tobacco
- W Forest or woodland - old timber
- X Idle land
- Z Miscellaneous crops, vegetables, small fruits, etc.
- (2) Field numbers

DOLLARS ARE SAVED, AS SOILS ARE SAVED, IN 12 NORTHEASTERN STATES

SOIL conservation dollars grow bigger—buy more terraces, diversion ditches, contour furrows, fences.

Projects throughout the United States prove not only that erosion can be controlled but that it is possible for the average farmer himself to undertake the conservation of his chief asset, the soil.

Cost reductions, revealed by carefully kept records in all regions of the Soil Conservation Service, are being brought about as a worth-while by-product of mounting efficiency and increased simplicity of methods.

Survey Points the Way

In response to an inquiry by this publication, Dr. A. L. Patrick, regional conservator for New England, New York, Pennsylvania, Delaware, New Jersey, Maryland, and West Virginia gathered reports from a number of projects and camp areas which point the direction which economy is taking.

Until June 1936 terracing as a method of controlling erosion and conserving moisture had never been used in any of the States of the Northeastern region. It was introduced by the Soil Conservation Service. Most of the personnel was unfamiliar with the construction of terraces and as a consequence the first costs were high. Many farmers soon became convinced of the effectiveness of this type of soil and water conservation and in every locality the practice has spread.

As the work increased, efficiency improved. In New Jersey the cost of terracing has been reduced 85 percent. In Maryland costs came down 75 percent. Present costs are still high, but are being rapidly reduced as operations expand.

Similarly, the cost of terrace outlets has been reduced 50 percent in New Jersey and 90 percent in Maryland. This is due in large degree to better planning of terrace projects and to more efficient execution of the work.

The cost of diversion ditches has been reduced from 75 percent in some places to more than 90 percent in others. This decrease is due primarily to greater use of equipment and power by both the Soil Conservation Service and the farmers.

The cost of fencing has been reduced 40 percent and that of tree planting 55 percent.

Closer Supervision

It might be well to note that the greater part of these cost reductions has been effected since the establishment of the regional office. This provided closer supervision, the benefit of assistance from more experienced personnel, and a more thorough coordination of the program.

Diversion ditch in Pennsylvania constructed by hand labor at a cost of 34 cents per linear foot.

A diversion ditch similar to that shown on opposite page, constructed by power machinery at a cost of 2½ cents per linear foot.

A factor in the originally excessive costs was the necessity of using large numbers of workers who were untrained and inexperienced in this type of work, mostly C. C. C. and W. P. A. employees.

The contour furrowing of pastures has long been recognized by the Soil Conservation Service, for its value in soil and water conservation. It is only within the past 6 months, however, that strides have been made toward more economical methods of doing the work. Within this time the average cost of contour furrowing throughout the region has been reduced 62.5 percent—a very material saving to the Government.

A Pennsylvania Project Reports

A REVIEW of some of the savings effected on various projects, operating under a variety of conditions, may be of interest.

At Sligo, Pa., costs of controlling gullies have been cut by the substitution of diversion ditches for expensive check dams, where that is feasible. The water is diverted through ditches to a satisfactory outlet, or is spilled onto a pasture where it really does some good. By using machinery, the expense of constructing diversion ditches has been reduced from 58 cents per foot to 36 cents. This is considered a big improvement over the former hand method.

Woodland specialists here have brought down the cost of building fences from $2.90 per rod to $2.01 per rod, by the simple expedient of tacking wire to trees.

A slight reduction in cost of planting has been effected through the use of contour furrows. The furrows act as small diversion ditches in controlling run-off.

Within the watershed a trend toward strip cropping is evident. Many farmers not now under cooperative agreements are following the suggested revised layout on their farms rather closely. Probably one-third of them have installed strip cropping.

Many of the farmers outside the watershed have a very hazy conception of the work being done. Where there is strip cropping on the contour it is usually a practice that has been followed for a number of years and as a result of the farmers' observations.

It is unlikely that there will be a material spread of conservation practices until the revised layout on the farms of cooperators becomes completely evident, which in instances will not be until the crop years of 1937 and 1938.

During the later summer the camp received a grader and terracer, which were immediately put to work constructing diversion terraces. Up to that time the cost had averaged 34 cents per lineal foot. That figure through the use of the grader was reduced to 20 cents. For those diversion terraces that have been made largely with the machine the cost has ranged

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from 1 to 5 cents per lineal foot, depending on the amount of hand work necessary.

A Table That Tells Much

The following summary sheet shows a general reduction of costs in all types of work over a period of a year and a half. While this may not appear spectacular, it nevertheless shows a continuous improvement in efficiency of operations carried on by this camp.

Item	Nov. 30, 1935		May 29, 1936		Nov. 28, 1936	
	To date	Man-hour per unit	To date	Man-hour per unit	To date	Man-hour per unit
Tile ditch	2,333 feet	1	3,376 feet	0.8	11,181 feet	0.5
Diversion ditch	5,402 feet	1.2	6,272 feet	1	11,712 feet	.3
Diversion terrace	8,324 feet	1	9,274 feet	1	28,539 feet	.6
Bank sloping	866 square yards	2.2	3,950 square yards	.6	17,240 square yards	.3
Riprap	185 square yards	8.1	217 square yards	6.7	437 square yards	4.8
Seeding or sodding	313 square yards	3	313 square yards	3	1,039 square yards	1.1
Temporary dams	30	4	30	4	3	4
Contour strips			1,808 acres	.9	6,872 acres	.7
Lime quarry set-up			2,853 cubic yards	8.2	5,009 cubic yards	4
Lime quarried			1,472 tons	2.3	3,802 tons	2.
Lime pulverized			195 tons	2.5	1,804 tons	2.2
Lime hauled			195 tons	1.1	1,804 tons	.9
Maintenance, bank sloping			311 square yards	.4	761 square yards	.2
Maintenance, diversion terrace			2,297 feet	.1	7,947 feet	.08
Fence constructed	1,785 rods	5.7	3,580 rods	4	8,818 rods	3.2
Posts or braces cut	2,427	1	4,855	.8	10,625	.5
Fence removed	713 rods	2.4	1,292 rods	1	2,330 rods	.5
Trees planted	114,250	.03	142,775	.04	204,550	.04
Seed collected	6,768 pounds	1.3	6,768 pounds	1.3	11,630 pounds	.7

This improvement can be generally attributed to an increased knowledge of local conditions gained through contacts with varied problems encountered as the work progressed as well as to the experience gained by the technical and supervisory personnel.

The summary sheet is based on data taken from the weekly work reports for the last week in November 1935, the last week in May 1936, and the last week in November 1936, showing the amount of work completed to date and the average man-hours per unit.

Employees Better Trained

THE manager of the Vandergrift, Pa., project ascribes reduced costs in putting soil conservation practices into effect to the use of machine instead of hand labor, to greater experience on the part of the supervisory staff, and to better job training given to C. C. C. employees who are doing the work.

The cost of building terraces on this project has been reduced from 23 cents to 8 cents per foot by the use of a terracer.

"In tree planting and fence building," he says, "costs of late have been reduced not so much by a change in method as by the fact that camp enrollees were better trained at the start. This illustrates the advantage of selecting enrollees especially for the work, when that can be done.

"It is of interest to note how the work is spreading among farmers not under contract. On a farm owned by W. H. Shoaff and operated by S. R. Main, strip cropping has been established on 13 acres and started on 15 acres more. Four acres of pasture have been treated with seed, lime, and fertilizer; 6 acres of alfalfa have been started; 6 acres of woods have been protected from grazing which formerly were pasture.

"Donald Culp, one of our employees, has instituted some of the Soil Conservation Service practices on his father's farm. These include strip cropping and tree planting."

Fencing in West Virginia

AND from Moundsville, W. Va., comes further information on how efficient conservation is being achieved at less expense:

A more efficient operation of work crews has reduced the cost per rod of fencing by about 15 percent. The quality of the fence is high. The reduction is due to increased labor efficiency.

A 25-percent saving in the cost of construction of contour furrows has been achieved.

The use of machinery suited to the construction of diversion ditches has reduced the cost of this work by about 40 percent.

The permanent check dams now being constructed are proving more effective than those which were being built on July 1 but the cost of construction has been reduced by about one-third. The same is true of the temporary dams. These are now being built so that the cost for materials is greatly reduced and the principal charge is for labor. The saving amounts to nearly 30 percent.

There has been a 33.5 percent reduction in overhead costs for farm planning by the technical men of the staff. The men have increased in efficiency as they have gathered experience.

It is felt that costs on this project have been running at a rather conservative figure but the fact that they have been uniformly reduced without loss of efficiency during the past 6 months indicates that future improvement may be expected.

Plans Laid on Rainy Days

SOME interesting suggestions are found in these notes from the project at Waynesboro, Pa.:

Cost of laying out strips has been reduced by discussing the layout of strips with the farmer, with the help of a penciled copy of the revised land-use map. Increased experience of the W. P. A. strip-cropping crew allows them to measure more accurately the distances on the map, so that the men who work with the farmers can plot the finished map on rainy days.

The use of a plow supplemented with the V-drag has reduced the cost of diversion-ditch construction, as this equipment requires less hand labor.

By the use of a plow, a ditcher, and other machinery, the cost of bank sloping has been reduced considerably. The cooperators' tractors and horses are employed wherever possible.

The cost of removing outcropping limestone for pulverizing has been lowered by using a tractor and grab hook on chain for pulling rocks out of the ground so that they can be pounded into movable size by C. C. C. labor.

Three farmers in the Waynesboro region were led by the demonstration to install strip cropping in 1936. Approximately 200 acres of land have been treated thus on the farms of H. G. Benedict, Robert Ridenour, and Dan Miller.

New Type of Ditch Developed

SIMILAR progress is observed on the Hagerstown project, in the neighboring State of Maryland:

Prior to July 1936, diversion ditches built to an adequate cross section, with comparatively steep side slopes, were employed to divert surface run-off from the heads of gullies and to remove accumulated surface water. These ditches were in some instances difficult to cross with farm implements and required considerable hand labor to construct. This type of ditch was under construction during June 1936 and was costing 56 cents per linear foot.

During the month of June the project developed the so-called diversion terrace, in the hope of lowering costs and increasing the adaptability of ditching to farm operations. To replace the old type of ditch and develop a sounder control measure, utilizing the beneficial qualities of the diversion ditch, terraces were designed and constructed having sufficient channel capacity behind a comparatively low ridge to accommodate maximum run-off from contributing drainage areas. They utilize a channel grade that would develop a nonsilting, and at the same time a noneroding, velocity.

These diversion ditches were of the broad-base type, easily crossed by farm machinery. They were constructed wholly by a tractor and terracer. They were seeded to permanent grass and a permanent grass strip remains above each terrace as a filter to protect against further channel silting.

This type of diversion terrace has met with favor among cooperators and it has been used not only around gullies but above potential gully areas and on lines of division between some strips in strip-cropped fields.

Because of increased efficiency of machine operators and judicious choice of locations for use, the cost of this work has reduced progressively each month since June, as shown in the following table.

Month	Linear feet of diversion terrace	Cost per linear foot
June	3,125	$0.56
July	3,990	.36
August	3,936	.17
September	1,900	.092
October	1,183	.055

A total of 14,134 linear feet was constructed on 9 cooperating farms. This is a notable case of cost reduction through an improvement in engineering practices and the adaptation of a new design to meet local conditions. A 90-percent cost reduction on one form of conservation operations in less than 4 months' time is certainly a worth-while achievement.

In the Harwood camp area timber flumes constructed of native logs and castoff sawmill slabs protected with tar roofing paper have been built in gullies up to a depth of 30 feet in lieu of concrete or other masonry structures. Vegetation has been established in these gullies and around these flumes and this cheaper method of control of large gullies has been successfully demonstrated in this area.

This method can readily be adopted by farmers for the protection of their fields, since the cash outlay for materials is very low compared with the benefits derived.

A Combination That Pays

OVER in New Jersey the story of increased efficiency with increased economy continues:

"We have adopted some measures which we think will control erosion and which can be installed in lieu of more costly and extensive procedures", says the project manager. "Possibly the biggest improvement has been to combine strip cropping with diversion terraces, in place of the more costly complete terrace system. The first cost of installation is greatly reduced, and we believe that the combination will control erosion as effectively as a complete terrace system.

"Another practice which is reducing costs is the use of natural terrace outlets wherever possible. We have discontinued board or stone spreaders and are using sod spreaders with good results.

"Noncooperating farmers are beginning to use sodded watercourses, and some are cultivating their crops across the slopes, if not using actual contour tillage. Formerly they cultivated up and down hill."

Planting Iron Used

LAST fall on the Freehold, N. J., project all planting and seed spotting was done by planting irons. The sandy soil of project area 3 and camp area 2 lent itself to this practice. The iron used consisted of a wedge-shaped head and a pipe handle 52 inches long, the assembled implement weighing about 15 pounds. The two dozen such irons made at a local foundry for $1.13 each, paid for themselves in one day. At the time this report was made more than 75,000 trees had been so planted.

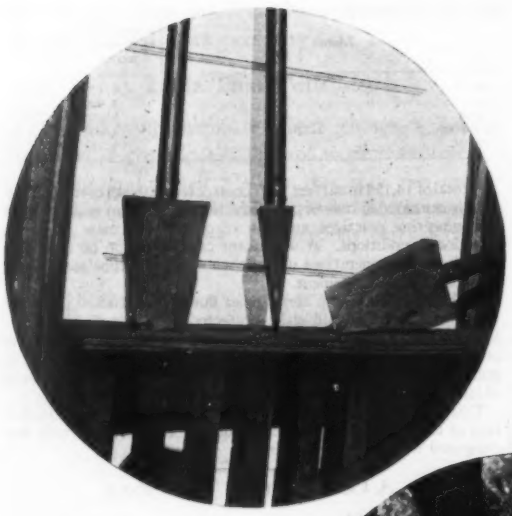
Use of these irons cut the cost from 5.4 man-days per 1,000 trees to approximately 2.6 man-days, the cost per 1,000 being reduced from $26 to slightly less than $12.

"While this iron is not applicable to all kinds of soils," it is pointed out, "the possibilities of its use should not be overlooked. We found it equally efficient in planting all our coniferous stock, locust, and even red oak and chestnut."

New York Farmers Follow

SOIL conservation practices are spreading in the vicinity of the Bath, N. Y., project. One farmer constructed a diversion ditch 700 feet long after it was laid out by an S. C. S. engineer. The cost to the farmer was 3 cents per foot.

Another farmer, a cooperator, and three noncooperating neighbors, excavated and hauled to their farms more than 100 cubic yards of marl, following demonstrations by the S. C. S. The cost approximated $1 per ton of lime, delivered to the farms.



Planting irons have sliced seed-spotting costs in half on the Freehold, N. J., project. The pictures show some of these irons and illustrate their use.

In some instances strips have been fall-plowed by noncooperators. They were not always on the contour, however, reflecting the need for developing an inexpensive farm level adapted to field use.

Many farmers have fertilized their pastures, as a first step toward their improvement. This they have done as a result of watching the farms of cooperators, who started doing this in the spring of 1935.

Attica Work Watched

The Attica camp has recently been visited by various interested groups, including the county agents of western New York and the supervisors of Wyoming County. Eagerness to adapt the project practices is evinced by numerous farmers several miles distant, numbers of whom are asking that a county conservation agent be employed to help them in their efforts to conserve soil and water.

The manager of the Bath project cites very considerable reductions in the cost of constructing diversion ditches in the project area and in two associated E. C. W. camp areas. The very low cost of 8 cents per lineal foot of ditch has been attained in one camp area. Tree-planting costs have been materially reduced.

Some Ideas That May Help

"Pointers" on cost reduction are enumerated as follows:

1. Biweekly field inspections by project staff members and State coordinating staff.
2. Periodic tours to stimulate interest and encourage better practices and education.
3. Careful accounts and comparisons, to keep field men conscious of the necessity of low costs and high efficiency.
4. Preliminary training, lectures by technical men to foremen, preliminary visits to job by technical men and foremen, planting schools for foremen, training on proper use of tools and other equipment.
5. Keeping same workmen, so far as possible, on types of work for which best fitted.
6. Planning travel schedules of trucks, etc., in advance to avoid excess travel and loss of time.
7. Informing all camps as to improvement of practices elsewhere.
8. Using large crews (25 men each), which may be subdivided into smaller units.
9. Feeding men in field, to avoid loss of time, excess travel, etc.
10. Preliminary planning by forester, so that trees may be ordered by the truck load and quickly heeled in on farms, with little travel from area to area.
11. Preliminary planning, to avoid travel on bad-weather roads.
12. Use of work orders, enabling foreman to know full particulars as to nature of job, location of job, and labor, materials, and equipment required. Foremen's reports not in reasonable conformity with estimates may then be given immediate check and analysis.
13. Placing definite responsibility for planning and executing work in specified area.
14. Holding weekly staff meetings to discuss problems, coordinate work divisions.

Versatility Encouraged

In the Lisle, N. Y., camp area the drift has been away from specialization. That is, there is no "fence crew", no "brush crew." Experience there indicates that specialization is not essential to efficiency. With comparatively few types of work to be done, a good crew soon becomes expert at a variety of tasks.

When a farm is released for work a foreman is assigned who is expected to handle the entire operations on it. The farmer has but the one foreman to deal with, and when one operation is finished the crew goes immediately to another on the same farm. This saves in time and transportation, makes for economical distribution of labor, and for better relations with the farmer.

The evidence points to more care on the part of nearby farmers in plowing and planting on the contour than in the past—a step definitely in the right direction.

Another List of Suggestions

ON THE Chenango Valley project at Norwick, N. Y., again we find costs diminishing. As a result of the experience accruing there, the project manager is enabled to advance these suggestions:

1. Have sufficient equipment at hand, properly maintained.
2. Encourage farmers to supply more of the labor and materials.
3. Reduce the amount of relief labor, weeding out the inefficient, and retaining small crews of capable men.
4. Employ small crews to bring down the expense of fencing.
5. Save by using experienced foremen and laborers, who are acquainted with the work and interested in it.
6. Sign enough agreements ahead so that work may be laid out for the most efficient use of labor and equipment.

THE C. C. C. AND SOIL CONSERVATION IN SOUTHWEST

(*Continued from p. 164*)

inundation of floods caused by rapid run-off from barren drainage areas.

Enrollees in these 10 C. C. C. camps, under the supervision of technical men, have accomplished voluminous work which already has proved effective for soil and water conservation and revegetation. They have worked a total of 297,652 man days (to and including Sept. 30, 1936) to complete work as follows: 14 large impounding dams with a total volume of 75,000 cubic yards together with 49 small reservoirs have been constructed; these serve a dual purpose as they not only impound water for stock but also help to control floods. Fifty-four thousand rods of fence have been built to keep stock from range until it is ready for grazing. There are 900 miles of contour furrows to hold water where it falls and thus check erosion and conserve much needed moisture for vegetation. To control gullies 30,000 check dams have been built, 19,633,000 square yards of banks have been seeded or sodded, and 407,000 trees have been planted. There have been constructed 123,000 lineal feet of ditch to divert water from gully heads and to spread it where needed for vegetative growth. Some 150,000 acres of public land have been rid of objectionable rodents, at least for the time being; and a topographic survey has been made of 49,000 acres. A total of 1,542 tons of stone for structures and riprap have been quarried and hauled. A million square yards of stream banks have been protected with jetties, riprap, and planting. Approximately 35,600 cubic yards of earth, stone, brush, and like materials have been used to make water spreaders to prevent the concentration of run-off in narrow channels. With flood prevention as the objective, 300,000 square yards of stream banks have been cleared and cleaned. In addition to regular field operations C. C. C. enrollees have engaged in fighting fires, in relieving flood conditions at Las Cruces, N. Mex., and in assisting to meet other emergencies.

If the Soil Conservation Service and the C. C. C. continue to cooperate in the Rio Grande district, it is felt that measures for materially retarding the siltation of the Elephant Butte Reservoir can be effectively demonstrated, and the economic usefulness of that important project prolonged.

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WHISKER DAMS in

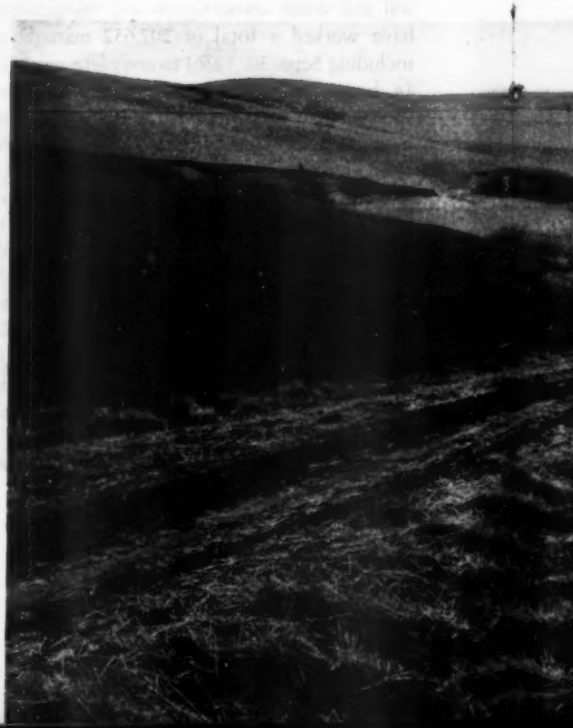
by C.Edwin Hill - Oregon Sta
Soil Conservation Se

In diamond at left: Tucking in the "

In diamond at right: Vegetation that

Above: This is how the dams looke

Below: Here they are at work; good little in



WHISKER dams have helped smooth out the gullies in Oregon. They have given the grass a chance to grow and while they were at that job they picked up a lot of silt and held it with the soil. Moreover, they performed this job with the materials at hand, requiring the use of but one implement—the old-fashioned spade. Other than the wielding of the spade they made very little demand for labor on the part of the men who put them in. A little history may serve to show how whisker dams established their worth.

Whisker-Dam History

The first scheme used to plug a gully was to build a series of dams across it so that silt would accumulate and ultimately fill the gully. The next was to smooth out the gully by filling in behind and even over the top of the dams and, immediately afterward, to start the grass cover. However it developed that during the long, rainless summer the grass was barely able to establish itself, and when fall came with occasional heavy rains these smoothed-out gullies frequently were washed out again by a swift flow of water and the new stand of cover destroyed. It was apparent then that some additional device was required to slow up flow and protect the grass.

Whisker dams were put in and they proved successful. Constructed across the gully and well up the side banks they stopped the water on its downhill course and prevented its escaping around the ends.

... in the NORTHWEST

- Oregon State Coordinator
Conservation Service

Tucking in the "whiskers" with a spade.

Vegetation that followed the "whiskers."

w the dams looked upon completion.

rk; good little impounders of water and silt.

The construction of whisker dams is simple: Take an old-fashioned, square-nosed spade and sink it in up to the handle. Move it back and forth until a little V-shaped trench is formed. Do this until you have a trench across the gully. (Do not try to use a round-pointed shovel; it won't work.) Next, cover the trench with straw, and with the square-nosed spade press the straw down into the trench. Close the trench and pack the dirt in it by shuffling along with the upright whisker dam between your feet.

While the Grass Grows

These dams perform several functions. They are built primarily to slow up the water on its pell-mell course down the gully and thus prevent washing out of the new grass seedlings. While the water hesitates, a more plentiful supply of it soaks into the ground and whatever burden of silt it carries is dropped behind and into the dams.

Whisker dams had a test in March 1935 when the winter snows were taken off rapidly by warm temperatures and heavy rains. In spite of the heavy run-off, not one of them cut out.

Understructures Eliminated

Furthermore, these water walkways may be used to hold the soil in gullies while vegetation is established without the larger understructures being present at all, thus cheapening the control of gullies. With the understructures eliminated, except in some

(Continued on p. 180)

MECHANICAL INGENUITY SPURRED BY PROBLEMS PECULIAR TO SOIL CONSERVATION

By Gerald E. Ryerson [1]

IN various projects and camps many special tools have been devised which make it possible for the field work of the Soil Conservation Service to be done much more efficiently. Both major and minor pieces of equipment have undergone changes to fit them to particular tasks and to local conditions.

Probably more different kinds of sod cutters have been constructed than all other types of machines. At least two-thirds of all camps and projects contacted have reported some particular form of sod cutter.

Sod cutters are small tools and yet when the large amount of sodding which is done by the Service is considered, it is obvious that these small increases in efficiency effect large savings.

At the present time it appears unlikely that a sod cutter will be built which will work satisfactorily under all conditions, this owing to the extreme variations encountered in soil and in sod.

To date two general types of sod cutters have been developed, each having its own advantages. Since it is probable that a great amount of improvement can be made on many of the cutters now used, an example of each type is shown, with the fundamental characteristics which all cutters must have to work properly.

Sled Type Has Rolling Coulters

The sled type cutter is used most commonly. Plans for one of the better examples have been submitted by the project at Mansfield, La.

Undoubtedly, other projects have designed cutters which work as well. This, however, is chosen for description because it is simple, well built, and essentially correct in principle.

Although the plans as shown are self-explanatory, it is considered advisable to point out the rolling coulters which cut the sides of the sod strip ahead of the blade. The use of coulters in this position is very advantageous, particularly when there is any dead material in the grass. The knife is attached to the inside of the runners, thus allowing the sod strip to rise over it without wedging. The knife is symmetrical; that is, the cutting edge slopes each way from the center of the blade. There is no particular advantage in having curved blade—a pointed blade with slightly rounded point is satisfactory. The sides of the blade should slope back from the point at an angle of about 30°. The runners as shown are made from channel iron, but any hard wood would be equally as good.

Attachment for Stiff Sod

Also shown in the plan is an attachment whereby boards can be fastened to the blade and drawn under the sod as it is cut. Boards 1 by 10 inches and 8 feet long are used with this machine. In operation, the procedure is as follows: A strip of sod 8 feet long is cut, the strip is broken just back of the cutter, and the board is removed and loaded onto the truck with the sod on it, then another board is attached to the cutter and the process repeated. This system seems to be extensively used in region 4. It can be used only where the sod is stiff enough to push itself along the board.

Roller-Type Sod Cutter

Another type of sod cutter, which for lack of a better name will be called the roller type, has been developed by the project at Spring Valley, Minn. This cutter has no runners of any kind. The depth of the blade is regulated entirely by a 2-inch roller which rolls on the surface just ahead of the cutting edge. As shown in the sketch, two coulters which cut the ege of the sod strip are welded to the ends of this roller.

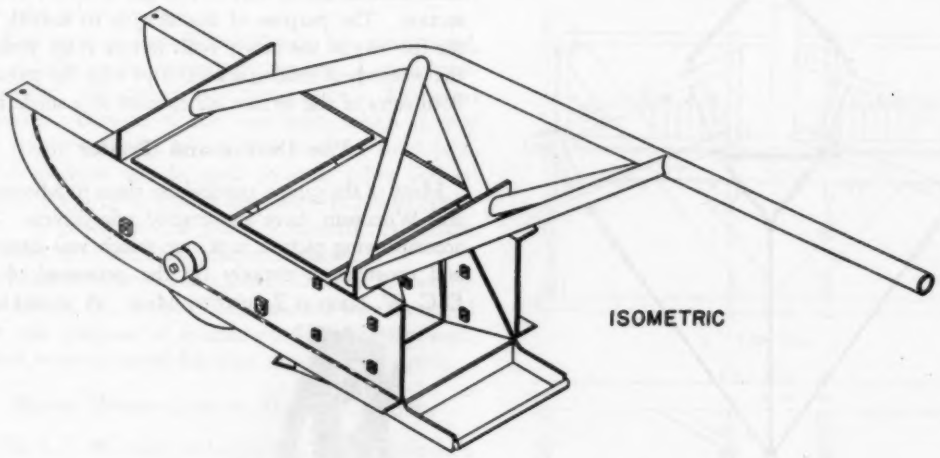
The blade on this machine is very similar to that described above except that it has one additional desirable feature. The cutting edge extends one-half inch outside the vertical sides of the knife. This allows small roots, etc., which become "hair pinned" over the cutting edge, to slide off the end without clogging in the corner.

Cuts at Uniform Thickness

This cutter also has two very distinct advantages for some localities over the sled type. It follows the irregularities of the ground surface much more closely, thus making it possible for the sod to be cut at a uniform thickness—a feature which is very important when the sod is to be used in "solid sodding" a water

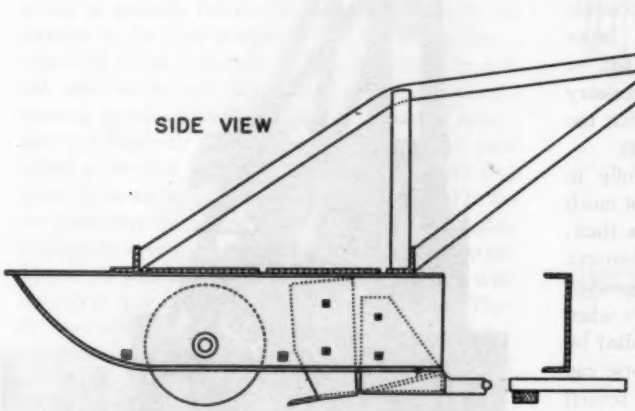
[1] Agricultural engineer, Soil Conservation Service, Washington, D. C.

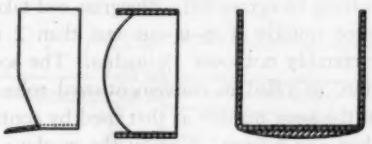
SOD CUTTER



ISOMETRIC

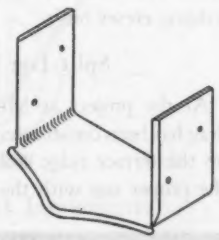
SIDE VIEW

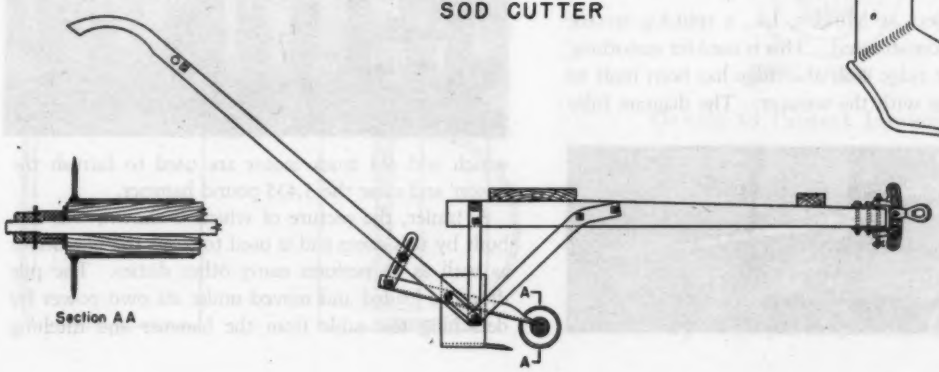




BLADE DIAGRAM

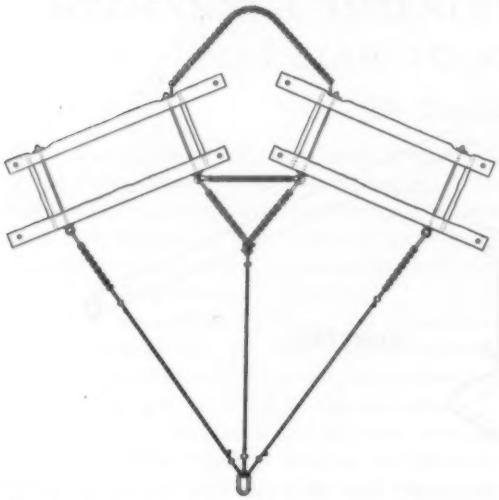
SOD CUTTER





Section A A

SPLIT LOG DRAG FOR TERRACING



channel. Another advantage is that it is possible to cut all of the sod where that is desirable. Since with this machine the depth of cut is regulated by the roller rolling over the sod, it becomes unnecessary to leave a strip of sod outside the knife so that the runner on that side may have space to operate.

This cutter has been used very successfully in cutting bluegrass sod. Bluegrass sod takes root much more quickly if it is cut less than 2 inches thick, preferably not over 1½ inches. The sod, when cut thin, is rolled in convenient-sized rolls and handled in the same manner as that used by contractors when they sod a lawn. Usually the machine is pulled by a pick-up or a horse. Two boys using a horse can easily cut and roll up enough sod to keep several sodding crews busy.

Split-Log Terrace Drag

At the project at Minden, La., a split-log terrace drag has been constructed. This is used for smoothing up the terrace ridge after the ridge has been built to the proper size with the terracer. The diagram fully explains the construction of this equipment. The dimensions as shown may be changed to fit any terrace section. The purpose of this drag is to smooth out the furrows in the newly built terrace ridge without the necessity of making several trips with the terracer. Both sides of the terrace are covered at a single trip.

Pile Driver and Trailer

Many of the camps, particularly those in Minnesota and Wisconsin, have constructed pile drivers. The accompanying picture is of one which was designed and constructed entirely by the personnel of the E. C. W. camp at Zumbrota, Minn. A second-hand

winch and old truck motor are used to furnish the power and raise the 1,435-pound hammer.

A trailer, the picture of which is shown, was also built by this camp and is used to move the pile driver as well as to perform many other duties. The pile driver is loaded and moved under its own power by detaching the cable from the hammer and hitching

when the sod is to be used in "solid sodding" a water it to the back of the trailer when loading, or to a tree or post when moving.

The camp at Red Wing, Minn., has constructed, in addition to the heavy-duty machine, a small hand-operated pile driver equipped with a 200-pound hammer. Because of the ease with which it may be transported and set up it is used for small jobs. This machine may be used on sheet piling and on round piling up to 14 feet long and 9 inches in diameter. A penetration of 8 feet is secured. A picture of it set up in operating position is shown.

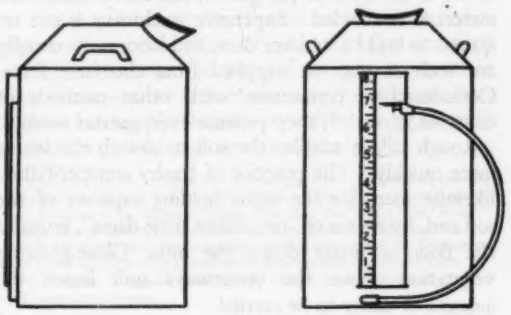
A sketch is shown of a cornfield roller devised by the LeRoy, Ill., project. This machine was developed for the purpose of mulching-in sweetclover seed, when sown in cornfields after the final cultivation.

Keeps Water-Cement Ratio Uniform

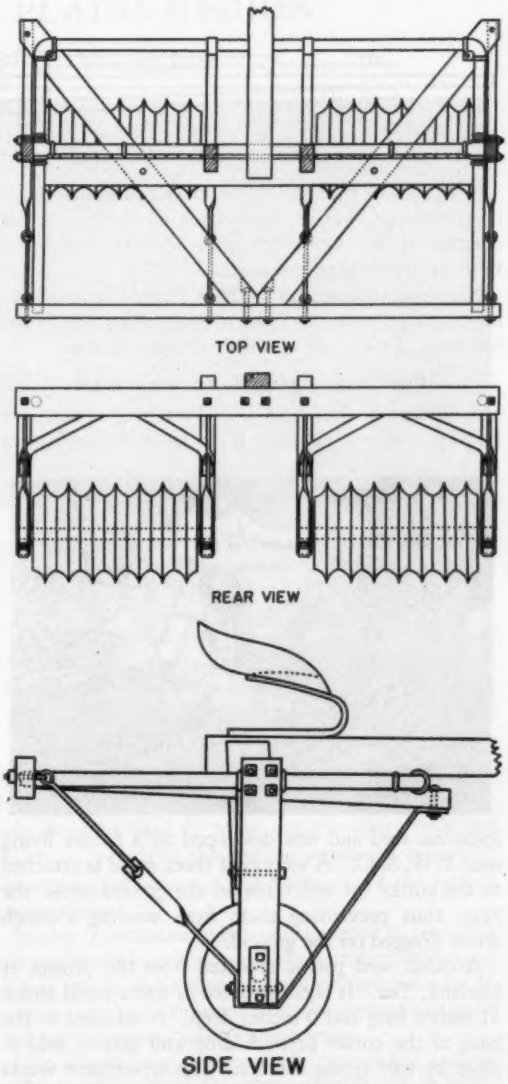
The E. C. W. camp at Galva, Ill., has constructed a water measuring can, used in concrete work, which makes it possible for the water-cement ratio of the mixture to be kept uniform. This measuring can, a sketch of which is shown, consists of a 10-gallon milk can with the top cut off just above the handles and a pouring spout soldered on. On the opposite side, a hole is drilled near the bottom of the can and a small elbow soldered in as shown. A scale showing the contents of the can in gallons and quarts is soldered to the can just above this elbow. Another elbow is attached to the scale in such a manner that it can be moved up and down. A pointer is soldered to this elbow flush with the top so that it points to the figures or scale. Then the two elbows are connected with a rubber tubing.

After the correct quantity of water to be added to any mixture has been determined, the pointer is set to the desired quantity and the can filled until the water runs out of the upper elbow, for each batch.

WATER MEASURING CAN



CORN FIELD ROLLER



TOP VIEW

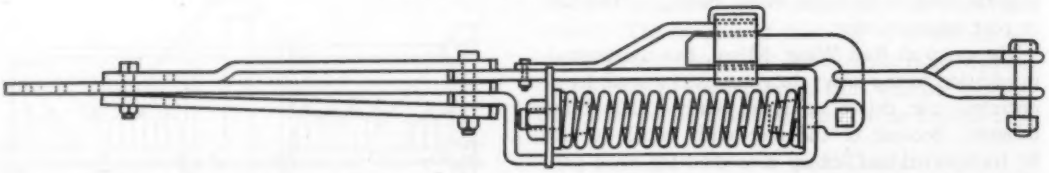
REAR VIEW

SIDE VIEW

Device to Protect Implements

A spring trip tractor hitch has been designed on the project at San Angelo, Tex. The purpose of this hitch is to protect implements which are pulled by a tractor from injury when roots or stones are struck. This hitch can easily be made in any project shop from the sketch shown. It will be necessary to purchase a spring having the proper compressive strength.

TRACTOR HITCH



It is probable that many other devices and tools have been developed in the various projects and camps. A description of these will be given in future articles as they are reported to this office.

Numerous changes and additions have been made to existing equipment to make it more adaptable to the job being done, some of which are given below.

For Harvesting Lespedeza Seed

A picture is shown of a seed-catching attachment for an ordinary mower. It is used in harvesting

lespedeza seed and was developed by a farmer living near York, S. C. A section of sheet metal is attached to the cutter bar and trails on the ground under the bags, thus preventing them from wearing through when dragged on the ground.

Another seed pan is reported from the project at Garland, Tex. It is constructed of sheet metal and is 31 inches long and 9 inches deep. It attaches to the back of the cutter bar. A drop end gate is held in place by two spring catches. The attachment works on the same principle as the lawnmower grass catcher.

In operating the mower and pan, one man follows behind the pan, keeping the seed and grass swept to the rear of the pan. A broom is used for this purpose. When the pan becomes full the attendant applies sufficient pressure to the end gate to cause it to open. The grass is then swept out in a pile without stopping the team.

Many of the camps and projects report placing centrifugal pumps on their concrete mixers to draw water from the source of supply and deliver it to the automatic measuring device on the mixers. These pumps are operated from the mixer motor.

Improved Pulverizers

The operation of pulverizers has brought about the development of many ingenious devices which improve the operation of these machines. The project at Caledonia, Minn., has mounted a barrel behind and above the feed opening. This barrel is filled with water and is connected to a pipe having a row of small holes in the lower side, which is placed at the back edge of the feed opening. A valve by which the flow of water can be regulated is placed in the connecting line. The project personnel claim that by properly regulating the flow of water, the amount of dust can be reduced below the nuisance point without reducing the production of the pulverizer.

From the project at Madisonville, Ky., comes the report that they have completely enclosed the lower as well as the upper elevator chain on their pulverizers. It is said that this prevents leakage of the pulverized lime and reduces dust materially. The project at Bedford, Ind., has constructed a sectional downspout for their pulverizer elevator consisting of sheet metal frustums linked together with chain. This downspout is similar to that used on silo fillers and may be lengthened or shortened by adding or removing sections.

Whisker Dams

(*Continued from p. 175*)

of the larger and steeper gullies, the cost of labor and materials is avoided. Expensive machinery is not required to build a whisker dam, and labor costs usually are such as may be supplied from the farm force. Considered in connection with other methods of controlling run-off, they promise even greater savings.

Rough tillage enables the soil to absorb the water more quickly. The practice of trashy summer-fallow likewise increases the water-holding capacity of the soil and, by means of "ten billion little dams", impedes the flow of water down the hills. Close-growing vegetation above the waterways will lessen the amount of water to be carried.

RECONNAISSANCE MAPPING OF NATURAL VEGETATION OF CENTRAL GREAT PLAINS REGION[1]

By Ben Osborn and H. L. Whitaker[2]

Typical scene in type phase of Quercus-Carya *(oak-hickory forest) in West Tuay Creek project, Ottawa, Kan. The shaggy-barked tree at right center is* Carya ovata K. Koch *(shagbark hickory), one of the dominants found only in old established stands of timber of this type.*

In the spring of 1936 the authors made a reconnaissance of the natural vegetation in the Central Great Plains region (Nebraska and most of Kansas and Oklahoma), and mapped on a scale of 1 inch to the mile the original native vegetation in the 15 demonstration areas there.

From 3 to 8 days were spent in each watershed area. Usually the first day in each area was used in taking floristic samples of the different types of vegetation and giving the area a general preliminary inspection. With a base map obtained from project headquarters. mapping was begun the second day.

The time required to complete a map depended upon the size of the area and the complexity of the vegetative pattern. In prairie country it was usually possible to see and to map the terrain for a mile in either direction from a car while driving at an average speed of 10 miles an hour. In wooded country it was more often necessary to drive along every section line. Aerial photographs helped considerably in locating boundaries of the forest types and phases.

These studies of the vegetation in the 15 projects scattered over the three States, and a limited amount of travel about the region, coupled with a study of the available literature on the flora and ecology of the Central Great Plains, enabled us to develop an ecological classification of natural vegetation of our region for reconnaissance use. We feel that the same methods could be used in other regions where sufficient relicts or records of the original vegetation remain to show the distribution of the dominants of the various communities.[3]

In this classification we have attempted to recognize the significant ecological units of vegetation within our region and to show their successional relationships in so far as can be determined from the present literature and reconnaissance field examinations.

The classification is necessarily provisional and, in order to be practical for reconnaissance use, is based upon empirical criteria which may be readily distinguished in the field.

The unit of an ecological classification of vegetation is the *association;* that is, the consistent occurrence together of certain species of plants in a recognizable

[1] This is the second of two articles. The authors wish to express their appreciation to Dr. Paul B. Sears and Dr. A. O. Weese, of the University of Oklahoma; Dr. F. C. Gates, of Kansas State College; Prof. H. I. Featherly, of the Oklahoma A. and M. College; and members of the technical staff of the Soil Conservation Service region 7, for their helpful suggestions and valuable criticisms in the development of the system of classification and method of mapping presented in this paper.

[2] Mr. Whitaker is regional biologist; Mr. Osborn is junior biologist, region 7 Soil Conservation Service.

[3] A more detailed exposition of our system of classification and of the ecological relationships, composition, and distribution of the various types of vegetation of our region is contained in our paper, "A Reconnaissance of the Natural Vegetation of the Central Great Plains Region", which is yet in manuscript form but which is available in the Soil Conservation Service regional office.

unit of vegetative cover under the influence of a single dominant or a few codominants. This is not to be confused with the formalized use of the word "association" by some recent ecologists as a designation of one of the major climax divisions of vegetation.

The delimiting of the associations in the sense herein employed usually requires more detailed study than is possible in a reconnaissance survey. The smallest division which we have found practical to recognize in reconnaissance mapping is what we have termed the *phase*, a successional series of associations of which each association is a *stage*. All the phases which lead, at least theoretically, to the same final association are considered to belong to the same type of vegetation. Those stages in which the characteristic species or genera of the final association are represented are said to belong to the *type phase* of that type of vegetation. Those stages or associations which develop in habitats more hydrophytic than that ordinarily occupied by the type phase are termed the hydrophase. Likewise, those which develop in habitats more xerophytic than the usual environment of the type phase are classified in the xerophase.

As names of these various divisions and subdivisions of vegetation we have attempted to use characteristic dominant or codominant species of the respective stages, phases, or types.

The types of vegetation are found related, primarily according to growth form, in *formations* coinciding with the accepted usage of this category in current ecological literature.

A further subdivision of the type into subtypes has been used to express the difference between the composition of the type in its different geographic portions.

This classification of vegetation has given us twelve types or ecotone types belonging to four different formations in our region. As a legend for our completed maps we have assigned a letter to designate each of these distinct types. The capital letter alone is used to signify the type in its entirety, including all its successional stages. If the type has been further classified as to subtype, an inferior numeral is used with the letter to designate the subtype to which it belongs. The capital letter with a prime (as A') designates the type phase of the type for which that letter stands. Small letters are used for the two successional phases, a small letter without a prime designating the hydrophase (a) and a small letter with a prime (a') designating the xerophase. Figure 1 illustrates the use of this legend upon a completed map.

By this method it is possible to use the same legend and be as specific or as general in the classification of

An example of a forest type of vegetation invading an original grassland community. A mixture of pioneer shrubs of the* Quercus-Carya *(oak-hickory forest) type establishing themselves in a watercourse running through an* Andropogon *(tallgrass prairie) type meadow. Grasses may be seen in the foreground. This woody community would not appear on the map of "original" vegetation.

the different units of vegetation under consideration as the circumstances demand. In reconnaissance work, it sometimes is impossible to determine reliably the particular phase or subtype of vegetation which originally occupied an area when the type may be determined with certainty. In that event, the legend for the generalized type may be used. Sometimes it may be possible to carry the classification no further than the formation, in which instance a roman numeral may be used in the legend. Divisions of different categories may be expressed on the same map, portions of the area being classified to their exact phases or subphases while more difficult parts are recorded only by the formations to which they belong.

A familiarity with the dominant species of the various stages within the several phases and types of vegetation is necessary to the recognition of these units in the field as the boundaries of the different communities are delineated upon the distribution of these dominants.

Needless to say, in mapping the original vegetation after several years or even decades of disturbance by agriculture, it is necessary to consider the possible shiftings in boundaries and the complication of the pattern by secondary successions. Each area presents a problem of its own which can be interpreted only in the light of a knowledge of its agricultural history (or history of disturbance) and of the important secondary successions.

To the casual eye this is tallgrass prairie, but the ecologist will observe the relicts of **Quercus marilandica** *Muench (blackjack oak sprouts) visible in the upper portion of the view and will map it as originally occupied by the* **Quercus marilandica Andropogon** *ecotone type.*

A preliminary trip over the area and a floristic sampling of the apparent different types of vegetation will generally serve as a basis for interpreting relict evidence of the original boundaries of the various plant communities. Usually it is possible after such a preliminary examination to draw the original boundaries directly upon the base map. If there has been much disturbance, however, it may be necessary to plot upon the map the locations of relicts of the origina- vegetation. From the completed map of relict local tions the boundaries of the original communities usually can be deduced.

The known preferences of certain communities for certain types of habitat will aid in assigning original boundaries, but should be used as secondary rather than as primary evidence. It is important to remember that *the vegetation is the indicator of the environment,*

Quercus marilandica-Andropogon (blackjack-oak Savannah) ecotone type at the Red Plains Soil Erosion Experiment Station, Guthrie, Okla. Note the tall grasses in the opening in the blackjacks, also the isolated trees in the grass stand, indicating the natural mixture of the two types of vegetation. At one time this was a badly overgrazed pasture, but protection from grazing and burning has permitted reestablishment of tallgrass species.

This relict stand of Andropogon scoparius Michx. (little bluestem) among the rocks where it is partially protected from grazing in a pasture in Saline county, Kan., is typical of the evidence that this prairie country was originally occupied by Andropogon (tallgrass prairie) type of vegetation.

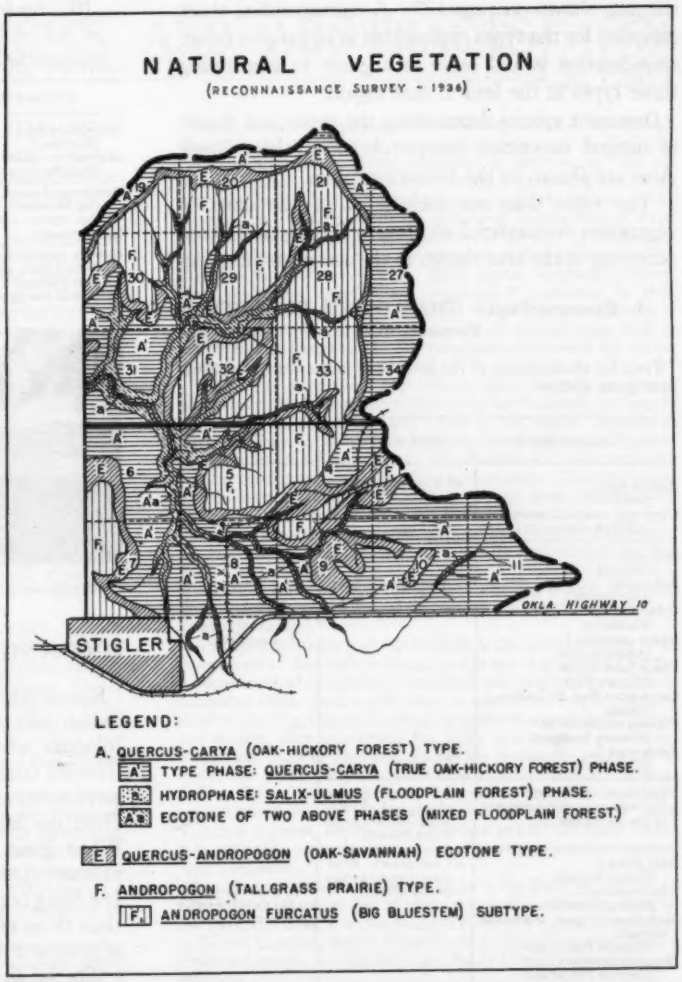
not the environment the indicator of the vegetation. Human appraisal of a given habitat may not necessarily be the same as that of the plant community faced with the problem of survival in that habitat.

If aerial photographs of the area are available, often it is possible to map the vegetation from them, after a preliminary field examination to determine what types and phases are present and the usual arrangement.

Earlier Phases Deceiving

Particular attention should be called to the deceptiveness of the early successional phases of the forest types of vegetation where they make contact with grassland types. In areas where disturbance has been present for a good many years, secondary successional tree communities may be growing upon areas which were not originally occupied by forests. Examination of tree rings and other evidence of the age of the community and a careful search for relicts of possible original grassland types are necessary to determine the status of present vegetation on the ground.

Attention should be called also to the general shift of types within the grassland formation to the eastward or to different portions of the topography in response to the varying effects of different degrees of overgrazing, erosion, and drouth. Here again relicts are of paramount significance. In the Central Great Plains Region an area generally can be assigned to the most nearly hydrophytic type of which relicts are present.


NATURAL VEGETATION
(RECONNAISSANCE SURVEY - 1936)
STIGLER
OKLA. HIGHWAY 10
LEGEND:
A. QUERCUS-CARYA (OAK-HICKORY FOREST) TYPE.
A TYPE PHASE: QUERCUS-CARYA (TRUE OAK-HICKORY FOREST) PHASE.
HYDROPHASE: SALIX-ULMUS (FLOODPLAIN FOREST) PHASE.
ECOTONE OF TWO ABOVE PHASES (MIXED FLOODPLAIN FOREST.)
E QUERCUS-ANDROPOGON (OAK-SAVANNAH) ECOTONE TYPE.
F. ANDROPOGON (TALLGRASS PRAIRIE) TYPE.
F1 ANDROPOGON FURCATUS (BIG BLUESTEM) SUBTYPE.

A portion of the reconnaissance survey map of the original natural vegetation of the Taloka Creek area, Stigler, Okla. Sections are bounded by broken lines. Different types of hatching have been substituted for the colors used in the original map.

Two Types of Relicts

In this connection two types of relicts should be recognized. The more significant and reliable is a patch of sod or area of timber which has never been broken or cleared and in which the original plant community, and possibly some of the identical individuals of the original stand, remain. This may be called a *community relict* and is reliable evidence of the original occupation of that area by that type. The second type of relict, which may be called a *species relict*, consists of the presence of a species from the original community, but not necessarily in its original position. It simply indicates the persistence of that species within the area. This type of relict will be significant in indicating that the environment permits of the survival of the species, which may be taken as an evidence that the community from which it is derived may originally have occupied the territory.

How the dominant species serve to classify different units of vegetation may be seen in the accompanying chart of dominants of the types and phases found in

the map shown on page 135. A corresponding chart compiled for the types represented in any region under consideration would serve as a guide to identifying those types in the field in that region.

Dominant species determining the types and phases of natural vegetation mapped in the Taloka Creek Area are shown in the following tables.

The table does not include all of the units of vegetation encountered in Region 7, but only those occurring in the area shown in the accompanying map

I. *Quercus-Fagus* (DECIDUOUS FOREST) Formation

Trees (or shrub species of the xerophase) in the absence of dominant grass species:

Dominant species	Phase or subtype	Type
Quercus spp. (Oak.) *Carya* spp. except *C. pecan.* (All Hickories except Pecan.)	A′ Type phase: *Quercus-Carya* (True Oak-Hickory Forest) Phase.	
Salix spp. (Willow) *Populus* sp. (Cottonwood) *Celtis* spp. (Hackberry) *Ulmus americana* L. (American Elm) *Ulmus fulva* Michx. (Slippery Elm) *Carya pecan* Engl. & Graebn. (Pecan) *Platanus occidentalis* L. (Western Sycamore) *Betula nigra* L. (River Birch)	a. Hydrophase: *Salix-Ulmus* (Floodplain Forest) Phase.	A. *Quercus - Carya* (Oak-Hickory Forest) Type.
Dominants of the type phase (A′) occurring with dominants of the hydrophase (a).	A′a. Ecotone of type phase and hydrophase (Mixed Flood-Plain Forest).	
Rhus glabra L. (Smooth Sumach) *Rhus copallina* L. (Shining Sumach) *Symphoricarpos orbiculatus* Moench. (Common Buckbrush) *Diospyros virginiana* L. (Common Persimmon) With associated shrubs and vines in the absence of dominant tree or grass species.	a′. Xerophase: *Rhus-Symphoricarpos* (Shrub) Phase.	A. *Quercus-Carya* (Oak-Hickory Forest) Type.

II. Forest-Grassland Ecotones (SAVANNAHS)

Tree or shrub dominants from the *Quercus-Fagus* (Deciduous Forest) Formation with an intergrowth of grass dominants from the *Andropogon-Bouteloua* (Grassland) Formation, either as a uniform mixture or in relatively pure patches too small to be mapped separately:

Dominant species	Phase or subtype	Type
Dominant species of the type phase of the *Quercus-Carya* Type (A′) with dominant species of the *Andropogon* Type (F).		E. *Quercus-Andropogon* (Oak Savannah) Ecotone Type.

III. *Andropogon-Bouteloua* (GRASSLAND) Formation

Grasses in the absence of significant tree or shrub dominants:

Dominant species	Phase or subtype	Type
Andropogon spp. (Bluestem.) *Sorghastrum nutans* (L.) Nash. (Nodding Indiangrass)	F′. Type Phase: *Andropogon* (True Tall-grass Prairie) Phase.	
Andropogon furcatus Muhl. (Big Bluestem) Other species subordinate to this dominant.	F. *Andropogon furcatus* (Big Bluestem) Subtype.	F. *Andropogon* (Tall grass Prairie) Type.
Panicum virgatum L. (Switch Panic-grass) *Spartina pectinata* Link. (Prairie Cordgrass)	f. Hydrophase: *Spartina-Panicum* (Wet Meadow) Phase.	

Strip cropping in Ohio: The photograph that suggested this month's cover.

ONE ANGLE OF THE FLOOD PROBLEM

Rivers out of their banks caused little or no loss to the Indian inhabitants of pre-colonial days. The white colonists who came over the Alleghenies, however, traveled farther inland by boat and established their settlements close to the banks of their river highways. From the first they felt the wrath of rising waters. When great cities grew up and industrial districts, railroad yards, and warehouses were forced into the low-lying regions, even floods of no greater magnitude than those of prehistoric times could take a rising toll of lives and dollars.

But the things that modern civilization—man-made geography—has done to the face of the earth have raised flood levels year after year. Streams that formerly utilized their age-old safety valves by spreading over worthless low lands have been confined by embankments and levees. Forests have been cut down; ground has been covered with the sloping roofs of buildings; streets and roads have been made impervious to water by paving; drainage ditches have been dug; hillsides have been plowed carelessly. Every falling drop of water in great areas has been helped to flow more quickly into streams—streams that have themselves been narrowed. Each decade, therefore, has seen old flood levels passed, even when rainfall has not increased. [Adapted from bulletin issued from headquarters of National Geographic Society.]

BOOK REVIEWS AND ABSTRACTS

By Phoebe O'Neall Faris

SOIL DEFENSE IN THE PIEDMONT. By. E. M. Rowalt. In Collaboration with Subject-Matter Specialists of the Soil Conservation Service. U. S. D. A. Farmers' Bulletin 1767. January 1937.

Within late years it has been established as a fact that unless measures are taken to restore eroded and gullied lands of the Piedmont and to prevent further soil waste, the agricultural security of the region will rapidly become a thing of the past. This bulletin not only presents a comprehensive brief history of the area in explanation of conditions as they exist, but explains fully the modern approved methods now being used for soil defense in this rolling foothill country extending through Virginia, the Carolinas and Georgia, and into Alabama. Mr. Rowalt's writing guides the reader, smoothly and surely, in "thinking" himself into the region and its soil problems.

In the early days of its settlement by white men the Piedmont was a land of luxuriant valley bottoms and forest-covered slopes, with loamy, humus-filled, granular soils through which surface waters slowly filtered to clear streams. The soils of sandy loam lay over the region as they had been formed throughout the ages and were held in place by roots of plants and protected and made absorbent by a layer of decaying vegetable matter. Water-power resources were such that every settler could have a mill of his own for the grinding of his grain. Forest-covered slopes protected the lowlands from destructive floods.

Today farming in the Piedmont is a precarious venture. For the reason that they were infrequent and scattered, and mechanical structures crude and ineffective, attempts by individual farmers throughout the past century to save the soil were failures. Gullies formed at terrace ends and from hillside ditches. Topsoils washed from deforested slopes into the streams; bottom lands became buried in unproductive silt. Sheet erosion appeared on field after field. There are areas in the Piedmont which lost all their topsoil by sheet erosion within the short space of 30 years.

When figures were assembled from the reconnaissance survey made in 1933–34 by the Soil Conservation Service, the Piedmont as it emerged from a century and more of harmful agricultural practices was revealed as one of the most seriously eroded regions in the United States. With a large percentage of the area deprived of three-fourths of all its topsoil, it became apparent that the good land which remains must for the security of the population be protected from further impoverishment through erosion.

In recent years, with the realization that, given the opportunity, nature will work with man instead of against him in a constructive program for soil husbandry, erosion-control measures have taken a new course. The body of this bulletin describes separately and in detail the important practices now used in defense of Piedmont soils. Photographs are included to clarify explanations.

The modern broad-base terrace, as based on the principle that "slowing the speed of flow of water causes it to lose most of its power to carry a soil load", is described with regard to design and effect. The Nichols terrace, preferred for Soil Conservation Service demonstration areas in the Piedmont, is referred to as "an intercepting and drainage structure" and when constructed and maintained with care as to proper grade in the channel, takes advantage of water flow by breaking a long steep slope into a series of moderate slopes. As expressed by the author, "the Nichols terrace is, essentially, a broad, shallow ditch buttressed on the lower side by an embankment of earth. It is built entirely from the upper side by moving the soil down from above. Most of the water behind the terrace flows in a channel below the original surface of the ground, and complete terrace failures therefore seldom occur."

A table is included showing recommended spacing with regard to slope gradient for terrace construction. The laying out and maintenance of waterways for prevention of gullying is discussed in detail as the important feature of successful terracing.

As to contour tillage, a second soil-saving measure, Mr. Rowalt emphasizes its importance by stating that "row crops on all sloping lands in the Piedmont should be grown on the contour" for the saving of labor, water, and soil. Contour furrowing should be practiced particularly on upper terraces, with the terrace as the contour line—this measure being of value in slowing flow of water on upper intervals where erosion is most severe. In connection with contouring, strip crops are recommended to protect erodible slopes in times of heavy rains. Small grains, sorghums, clovers, grass, vetch, and lespedeza are mentioned in particular for strip cropping in the area under discussion. Lespedeza, and mixtures of sorghum and soybeans and cowpeas, are of especial value both as soil savers and forage crops. Rotating strips is stressed for double protection.

The fact is pointed out that cotton, corn, and tobacco, grown persistently throughout many decades in the Piedmont, are largely responsible for the serious soil waste in the region. Results of tests are given to show that legumes, small grains, and pasture grasses, used in proper rotation, will decrease soil losses, conserve moisture, and at the same time add organic matter. Of all the plants tested, lespedeza and Bermuda grass proved most efficacious for protection of the eroded slopes and buried bottom lands.

Another measure, recently adopted, which has proved extremely practical in sections of the Piedmont is contour furrowing in pastures. This is for the conservation of moisture and, indirectly, the control of erosion on slope pastures. Before the furrowing is done, all eroded spots and small gullies should be plowed, smoothed, fertilized and limed, and seeded.

An important feature of this bulletin is the section dealing with gully control. Emphasis is placed on the use of grass dams for the quickest method of securing a stabilized soil condition in gullies in cultivated fields. Such a gully may, in some instances, be partially filled by plowing, then seeded to grass mixtures or perennial legumes and grasses, thus converting the gully into a grass waterway. Temporary dams or diversion ditches are frequently necessary to divert the water until revegetation is secured—this in the large gullies. Many plants native or adapted to the Piedmont have proved themselves of inestimable value for gully control. The perennial legumes, kudzu, and *Lespedeza sericea;* the black locust tree and native pines; honeysuckle; and grass mixtures have proved most successful.

In a chapter with the heading "Etching the Story on the Land" Mr. Rowalt describes the erosion-control demonstration work in five Piedmont areas, i. e., the Banister River of Virginia, Deep River in North Carolina, South Tiger River in South Carolina, Sandy Creek in Georgia, and the Buck and Sandy Creek demonstration of Alabama.

A final chapter tells how terracing clubs in Tallapoosa County Ala., grew into soil-conservation associations with full programs involving * * * "the building of terrace-outlet channels, abundant use of cover crops in an improved crop rotation, contour tillage, strip cropping, gully control, permanent-pasture seedings, forest plantings, and practices for wildlife conservation."

SOIL CONSERVATION SURVEY OF THE SOUTHERN GREAT PLAINS WIND-EROSION AREA. By Arthur H. Joel. U. S. D. A. Technical Bulletin No. 556. January 1937.

This analysis of the erosion conditions in a 25,000-square-mile area in the heart of the so-called "dust bowl" is not merely a survey report. In addition to the presentation of data gathered by the Soil Conservation Service reconnaissance survey the author gives a comprehensive discussion and interpretation of the various conditions identified and mapped, particularly with respect to wind erosion and associated problems. Mr. Joel is in charge of the western field office, Section of Conservation Surveys, Soil Conservation Service.

BOOK REVIEWS AND ABSTRACTS
Continued

The area includes 20 counties in southeastern Colorado, southwestern Kansas, and the Texas and Oklahoma Panhandles. With its limited precipitation, high average wind velocity, generally thin stand of short grass and associated plants, and its unconsolidated soils of various stages of development, this region becomes peculiarly susceptible to accelerated erosion by wind over the whole 20 counties and by water in limited sections of unproductive soils. During recent years, with intensive grazing and cropping and failure on the part of landowners to provide adequate protection for the soil, the situation has reached the point where it requires serious attention founded upon a full knowledge of facts as they exist.

The survey involved the collection of data regarding climatic conditions of the area, general topography, vegetation, soils as related to erosion, agriculture and land use, and types and degrees of accelerated erosion.

In the study of the soils from the standpoint of erodibility, nine groups were used, each having types with distinctive and related features and characteristics of erosion susceptibility and erosion-control possibilities. It was found that soils of group 1, comprising 24.5 percent of the surveyed area, consist of silt loams and clay loams and are underlain by heavy clay subsoils. The topsoils when cultivated become loose and friable and are high in moisture-holding capacity, although their absorptive capacity is relatively slow. Owing to their loose friable structure they are very subject to wind erosion. The lands are heavy and generally of smooth topography and therefore suited to wheat production with the use of heavy farm machinery. When not properly cultivated, however, young plants often suffer from wind erosion.

Soils of groups 4 and 5, comprising a little more than 35 percent of the area, include the heavier and light sandy soils, and are readily susceptible to serious wind-erosion damage under cultivation, unless the farming system is well adapted to moisture conservation and erosion control. Large areas of subsoil are already exposed on these types, and sand dunes have formed in some localities. The author states that these sandy soils usually are well adapted to crops of the sorghum family and that these fibrous-rooted plants are especially useful on areas where the wind erosion is serious. Soil groups 6, 7, and 8, totaling 5.7 percent of the area surveyed, include the dunes, stationary and shifting, and the stream bottoms and terrace-lands used mostly for pasture or seriously eroded. The land of group 9 is chiefly of rough, broken topography, much of it nonarable.

In the presentation of a table showing distribution of cultivated, idle, and pasture lands in the 20 counties surveyed, 1,380,414 acres are listed as idle land. Since this immense acreage has become temporarily or permanently abandoned largely because of serious wind-erosion damage, it is apparent that the necessity for control, to prevent increasing abandonment, is extremely important.

The erosion-conditions survey of the area is presented in detail and discussed at length. The field survey pattern is indicated on maps, thus furnishing a very helpful guide for the formulating of land-use readjustment policies. It is found from studying the data that 96.9 percent of the area is affected by accelerated erosion of various types and degrees, while 53.4 percent has been seriously affected. It is stated by the author that "wind erosion is not only by far the most important type of erosion, but also probably the greatest single physical problem facing the area."

Only 4.4 percent of the region is affected by water erosion; but since there is great loss of moisture on soils both cultivated and uncultivated, the need for moisture conservation is urgent. All soils except those of alluvial stream flood plains and low terrace lands (3.1 percent of the entire area) have been damaged to a serious degree and are therefore rated as seriously susceptible to erosion when unprotected by vegetation.

Remedial measures as set forth for the area, based chiefly on physical conditions mapped by the survey, include soil-conservation practices such as immediate revegetation, tillage in relation to erosion control, and moisture conservation, all to be based on basic surveys of lands affected. Land-use readjustments in relation to soils and erosion are recommended also. It is important that over-cultivated and idle lands be returned to permanent vegetation, that acreage be properly distributed, and that farming methods be adapted to the soil, climatic, and topographic conditions.

Accompanying the report, in the detached appendix, are individual maps of each of the 20 counties and a summary map of the entire area surveyed.

Eighteen Farmers say "We'll Do It Ourselves"

(Continued from p. 166)

Summary—H. W. Lawson farm

Crops	Average acreage before agreement	Acres of crops as planned in agreement					Average acreage after agreement
		1937	1938	1939	1940	1941	
CULTIVATED							
Corn	8	6	6	9	6	9	7
Tobacco	4	4	4	4	4	4	4
Cotton							
Other row crops		3	3	3	3	3	3
Total	12	13	13	16	13	16	14
SEMIEROSION RESISTING							
Small grain	12	6	10	10	9	10	9
Beans and peas							
Total	12	6	10	10	9	10	9
EROSION RESISTING							
Temporary meadow		13	9	6	10	6	
Permanent meadow		9	9	9	9	9	9
Total		22	18	15	19	15	18
Permanent pasture		14	14	14	14	14	14
Forest		75	75	75	75	75	75
Total		130	130	130	130	130	130

Treatment in effect before contract, 75 acres; treatment newly planned, 52 acres; erosion-control planned, 3 acres; retired from semierosion crops, 9 acres. Work stock, 2; milk cows, 3; hogs, 2; poultry, 50. Graindrill, 1; mower, 1; harrow, 1.

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